Letters to the Editor

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X-ray, dielectric and resistivity studies in $SrGeO_3$

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Unlike other B ions in $A^{2+}B^{4+}O_3$ compounds Ge^{4+} ions seem to have attracted very little attention Recently some of these compounds have been found to exhibit interesting electrical and piezo-electric properties (Sugi *et al* 1971; Iwasaki *et al* 1971; Kher *et al* 1975) Here we report the structural and electrical properties of one of these, *i e* , $SrGeO_3$

Preparation of the compound

The compound $SrGeO_3$ is prepared by intimately mixing the two oxides SrO-GeO_2 (purity above 99 9%) in 1 1 molar proportion under acetone The mixture was heated in an electrically operated furnace at 750°C for about 50 hours in a platinum crucible The mass was then slowly cooled to room temperature to avoid the random distribution of ions in the lattice (Miller 1968) $SrGeO_3$ is found to be a white powder The compound does not show any evidence of being hygroscopic

X-ray study

The structure of the compound was investigated using 114 6 mm Debye-Scherrer camera and filtered CuK_α radiation The absence of GeO_2 lines as well as the presence of a new unit cell indicates the formation of the compound $SrGeO_3$ is found to have a tetragonal cell with $a = 3\,76$Å and $c = 4.06$Å ($c/a = 1\,08$) The observed and calculated d values are given in table The difference between the structure of $SrGeO_3$ reported earlier and that reported here is probably due to the prolonged heating at a lower temperature during its preparation (Miller 1968, Wycoff 1953; Harwood 1950) According to Goldschmidt (1926) criteria cubic perovskite structure is favoured in $A^{2+}B^{4+}O_3$ compounds if the tolrance factor t is between 0.77 to 1 $SrGeO_3$ with tolerance factor 0 92 would therefore be expected to possess similar structure $SrGeO_3$ is reported to possess a perovskite type structure at high pressures (Shimizu 1970) Intensity calculations for all the observed reflections assuming $BaTiO_3$ type structure (P4 mm) show very little agreement between the calculated and observed intensities This indicates that the structure of $SrGeO_3$ is different from that of $BaTiO_3$ (perovskite).

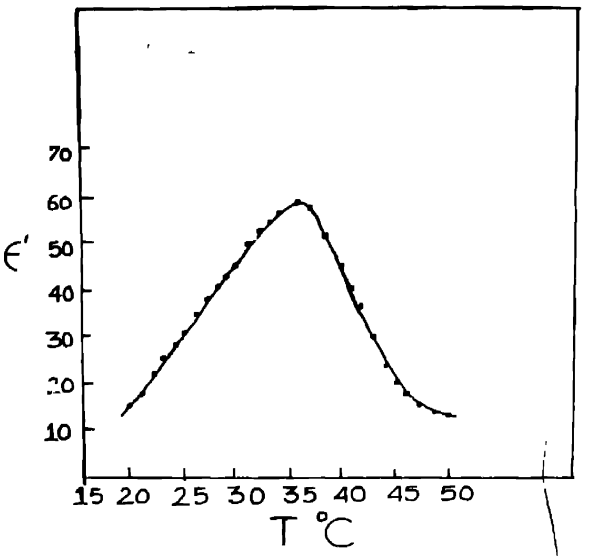

Fig 1 Variation of ϵ' with temperature.

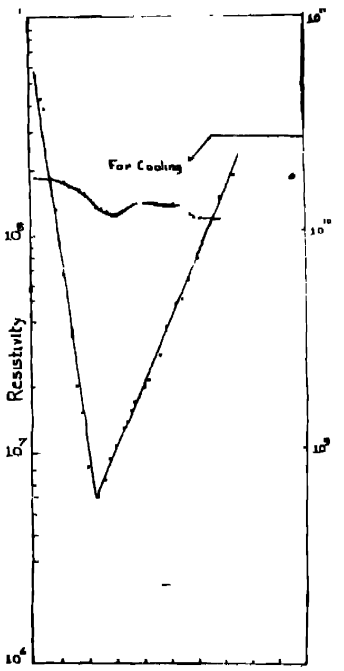

Fig. 2. Variation of resistivity with $1000/T(K^{-1})$.

Resistivity and Dielectric Study

The compound was pressed into pellets under pressure of 10 ton/sq inch in a hydraulic press for studying its electrical properties. The dielectric constant at 1KHz and dc resistivity of the sintered pellets were measured by Marconi Universal Bridge type TF 868/1 and B. P. L. meg meg ohm meter type RM 160/3 respectively. The variation of dielectric constant with temperature is shown in figure 1 and that of resistivity in figure 2. The dielectric constant and resistivity show a marked anomaly at 38°C. The anomalous behaviour is observed in all the pellets on heating but not reproduced in the cooling cycles. Identical results were obtained on repeating the measurements a number of times. The response to heating is spontaneous. This behaviour is similar to that reported in $RbNO_3$ (Rao & Rao 1964) and $LaCoO_3$ (Bhide *et al* 1972). The detailed investigation of the nature of the anomaly, space group and high temperature phase are in progress.

Table 1

(hkl)	*d* Observed	*d* Calculated	Intensity observed	Intensity calculated
(0 0 1)	3.994	4.063	w	1
(1 0 0)	3.678	3.762	s	1
(1 0 1)	2.763	2.760	m	100
(1 1 0)	2.657	2.660	s	91
(0 0 2)	2.046	2.032	v w	7
(2 0 0)	1.908	1.881	v w.	65
(1 0 2)	1.779	1.788	m	1
(2 0 1)	1.717	1.707	w	1
(1 1 2)	1.602	1.614	w	37
(2 0 2)	1.389	1.380	m	21
(2 2 0)	1.327	1.330	w	18

w : Weak, m : Medium, s : Strong, v w : Very weak.

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